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ABSTRACT

This analysis of the Internet and higher education focuses on two distinct models: one which is attempting to create "better, faster, cheaper" versions of today's courses and curricula through on-campus information infrastructure, and the other which envisions the Internet as the agent to transform higher education into student-centered learning rather than institution- and faculty-centered instruction in campus-independent ways. The paper first describes a number of academic projects that use the Internet for both on-campus instruction and distance learning. It then examines ways in which private-sector firms are using the Internet for training and education, with special attention to the firms' plans to cooperate or compete with academic institutions. The paper then addresses issues raised by the Internet's expansion into higher education including instructional costs, student access, the relationship between the private sector and academia, and the impact of the Internet on education. The paper concludes that learning from the Internet is likely to complement rather than supplant on-campus traditional higher education. (Contains 64 references.) (DB)

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Institute for Information Studies

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American higher education faces formidable challenges caused by changing student demographics, severe financial constraints, and lingering institutional rigidities.[1] At the same time, increased demands are being placed on higher education to provide greater student access to education, better undergraduate programs, and increased productivity. To address both sets of issues, institutions of higher education are turning to new communications and information technologies that promise to increase access, improve the quality of instruction, and (perhaps) control costs.

The use of older technologies for distance learning in post-secondary education[2] has already been shown to be cost-effective in such diverse settings as the Open University in the United Kingdom, four-year and community colleges in the United States, satellite-delivered video courses for engineers and other professionals, and corporate and military training. Now the Internet is being proposed as the preferred technology to improve instruction, increase access, and raise productivity in higher education.[3] College and university instructors now routinely post their syllabi and course readings to the World Wide Web. A few use lectures and other instructional materials available on the Web in their own courses. A growing number of schools offer at least some extension or degree-credit courses over the Internet. And more ambitious plans are in various stages of preparation or early implementation—plans for entire *virtual universities* that use the Internet to reach geographically dispersed students.

Two distinct models guide current efforts to make use of the Internet in higher education. The first approach seeks to improve existing forms and structures of post-secondary instruction—to create "better, faster, cheaper" versions of today's courses and curricula by means of the Internet. This model emphasizes building an on-campus information infrastructure that provides (or will provide) high-speed Internet connectivity to all students, faculty, administrators, and staff. Faculty then can use this infrastructure to improve and supplement traditional courses and degree programs. Library holdings can be digitized and made available both on-and off-campus.[4] Administrative processes can be speeded up and simplified. And although the focus remains on on-campus instruction, this new information infrastructure can facilitate distance learning for many categories of nontraditional, off-campus students. While this model of Internet use in higher education requires many changes among faculty, student, and administrative roles and functions, it keeps most existing institutional structures and faculty roles intact.

A different, more radical, model envisions the Internet as instrumental to a fundamental change in the processes and organizational structure of post-secondary teaching and learning. According to this view, the Internet can transform higher education into student-centered learning rather than institution- and faculty-centered instruction. It can allow agile institutions—old and new—to leapfrog existing academic structures and establish direct links to post-secondary students. It can encourage new collaborative arrangements between academic institutions and for-profit entrepreneurs and permit these partnerships to extend their reach nationally and internationally. It can accommodate student demand for post-secondary education in new ways that are basically campus-independent. If the markets for post-secondary

education evolve in this manner, the Internet may well threaten existing institutions of higher education much more than it will support them. Taking this view, celebrated management consultant and social commentator Peter Drucker recently remarked: "Thirty years from now the big university campuses will be relics. . . . The college won't survive as a residential institution."[5]

This chapter explores these two conflicting views of the Internet's evolving role in higher education. The discussion begins with an introduction to a number of academic projects that use the Internet for both on-campus instruction and distance learning.[6] The chapter then examines the ways in which private-sector firms are using the Internet for training and education, giving special attention to the firms' plans to cooperate or compete with academic institutions. The chapter concludes with a discussion of important issues raised by the Internet's expansion into higher education and the implications of this expansion for students, faculty, and academic institutions.

THE INTERNET ON CAMPUS

Although U.S. universities pioneered the development of the Internet and employed it for scholarly research in the 1970s and 1980s, its application to undergraduate and graduate instruction has occurred mainly in this decade. This extension of the Internet's educational function has brought about both a rapid expansion of the campus information infrastructure and an ongoing struggle with the financial and other difficulties inherent in the adoption of new technologies.

Expanding the Campus Information Infrastructure

American colleges and universities are investing heavily today to upgrade their computer systems, local area networks, and Internet links. More than fifty schools—ranging from community colleges to large research universities—have joined in the National Learning Infrastructure Initiative, a consortium created "to facilitate technology-mediated learning" on the nation's campuses.[7]

On American campuses, the Internet is now used primarily to supplement face-to-face lectures and other classroom activities, and to make course materials available for students' use at times of their own choosing. Common applications include: placing course outlines, syllabi, readings, and assignments on the Web; encouraging students to gather course-related information from the Web and submit papers and other assignments by electronic mail; engaging in one-on-one, student-faculty discussions via e-mail (a practice sometimes known as *virtual office hours*); and holding larger class discussions via e-mail. These applications are becoming widespread on campuses; the University of Illinois at Urbana-Champaign's Web site alone lists nearly 250 "classes with Web resources."[8] The 1997 Campus Computing Survey reports that nearly one-third of college courses now use electronic mail, up from twenty percent in 1995.[9]

People who argue that the Internet should be used to make on-campus instruction more student-centered and inquiry-based offer visions that feature entire courses held on the Internet, complete with lectures and multimedia presentations available on-demand or *asynchronously*; student access to fully digital libraries and information sources; interactive simulations of complex phenomena and real-world situations; Internet-based videoconferences with the leading scholars in a given field; and collaborative projects among students and experts from around the world. Demonstrations of such concepts are under way at a large number of colleges and universities.[10]

Cost and Other Obstacles to On-Campus Internet Instruction

But the Internet has not yet brought about major changes in on-campus instruction. It is still too new, too

costly, and perhaps too threatening to existing academic structures and traditions.

High start-up costs for on-campus networks and Internet-based instruction certainly pose problems. Many schools have been caught relatively unprepared for the heavy Internet usage of students who now come to college experienced in using computers and the Internet at home, in secondary school, or in summer or part-time jobs.[11] These undergraduates have high expectations for improving their computer skills and applying those skills directly in their course work. Their usage demands have brought some campus computer networks to their knees and forced administrators to ration Internet availability.[12] The provision of student access to computer networks, once considered a marginal add-on to the cost of research computing, now requires a large and growing budget of its own.

Developing new course materials for the Internet can also involve substantial initial costs, particularly of faculty time. While it is now relatively easy to put documents and other text on the Web, much of the Internet's power as a learning medium lies both in integrating relevant visual, aural, and textual materials and in providing access to these materials in nonlinear ways. Doing this well requires a good deal of instructor time, thought, and effort. In many cases it will also require support in the course-design phase from multimedia experts, support that few academic institutions today are able to provide.

One approach to dealing with the development-cost problem is to assemble courses using already-built instructional modules. The "World Lecture Hall" at the University of Texas and "Archive.edu" at the University of Houston, among other projects, are collecting and cataloging online courses and course modules and making them available free to other instructors.[13] As an illustration, the World Lecture Hall indexes and links to about fifty courses on economics, such as this course on Intermediate Microeconomics from the University of Delaware:

> Multimedia Web site with over seventy Java applets. Integrated textbook, lecture series, graphical calculator, animated drawing program, spreadsheet, and econometrics package. Lecture notes.[14]

The availability of such materials for downloading at no cost can in principle reduce the costs of preparing and delivering Web-based courses. However, instructors must already be familiar with the Internet to make use of the materials, and even Net-savvy faculty must spend considerable time reviewing materials and deciding how to incorporate them into their own courses. There are as yet no peer-review mechanisms for evaluating Internet curricular materials. And although instructors commonly use textbooks written by others, most are not ready to substitute multimedia course modules prepared elsewhere for their own on-campus lectures.

The basic concept of making the best presentations by the world's leading authorities widely available over the Internet seems job-threatening to some academics who fear that administrators, trustees, and/or state legislators, in their zeal to reduce costs, will see the Internet as a substitute for live instruction. Not a complete substitute, of course—face-to-face contact between faculty and students is still the essence of high-quality on-campus instruction, and seems likely to remain so for the foreseeable future. But live lectures to hundreds of students in introductory courses could be especially vulnerable to replacement by Internet-based, multimedia presentations from Nobel-prize winners or charismatic lecturers. The argument that this could in fact free up faculty time for more effective interaction with students in smaller groups has not yet been very persuasive in changing traditional teaching patterns.

Such concerns about technology's impact on teaching are not confined to the Internet, of course; the same possibilities and problems were raised fifty years ago with instructional television, and more recently with personal computers and multimedia CD-ROMs. With a few exceptions such as the Rensselaer

Polytechnic Institute "studio courses,"[15] television and computers have had only marginal effects on instruction and have not led to improvements in productivity. Like these technologies, the Internet must overcome the innate conservatism of academia and a host of institutional obstacles if it is to become more than a supplementary, cost-additive element of on-campus instruction.

THE INTERNET'S ROLE IN DISTANCE LEARNING

Distance learning is an increasingly important focus for educational institutions, which are struggling with the concept, weighing its advantages and disadvantages, and planning and executing pilot projects to test its effectiveness.

What is Distance Learning?

The concept of distance learning—that is, education and training off-campus or away from the source of instruction and information—goes back at least to the nineteenth century, when both academic and for-profit institutions began to offer correspondence courses by mail. Each technology for electronic delivery of information has subsequently been used for distance learning: the telephone; radio; broadcast, cable, and satellite television; audiotapes, videotapes, and videodisks; audio- and videoconferencing; timesharing on mainframe computers; PC software and CD-ROMs; and now the Internet.[16]

Distance learning is generally associated with part-time or "nontraditional" post-secondary students, particularly those who want to increase their job-related knowledge and skills. Some seek formal undergraduate or graduate degrees, while others enroll in classes leading to continuing education credits, certificates of completion or similar certification. Still others engage in distance learning for personal fulfillment rather than to obtain credits or credentials. Moreover, the potential market for distance learning includes such heterogeneous groups as:

- full-time students temporarily off-campus because of illness, work, or travel
- on-campus students who want to take classes from another institution
- people working full- or part-time
- military service personnel and their dependents
- parents at home with small children
- people living far away from educational centers
- prisoners
- retirees and others not actively working

In 1995, according to U.S. government and industry data, more than seventy-five million American adults, or about forty percent of all adults, participated in some part-time educational program. And part-time enrollment in higher education is growing more than three times faster than full-time enrollment.[17]

Most U.S. colleges and universities offer some distance-learning courses, usually through separate extension or continuing education divisions that employ part-time, nontenured instructors. Many community colleges, state colleges, and universities, and other schools that emphasize teaching have extensive distance-learning programs focused on part-time students who can receive course credits and earn degrees off-campus. But even elite research universities are competing more aggressively to offer continuing education classes to professionals, as they begin to recognize that distance learning offers a separate and growing revenue stream to financially strapped institutions, and begin to take steps so as not to be left out.[18]

Is Distance Learning Effective?

Numerous studies over the past several decades generally conclude that distance learning works and is cost-effective in imparting knowledge across a wide range of subjects to diverse categories of students.[19] Students who complete courses off-site typically learn as much and score as well on examinations as those who attend class in person. The costs for distance learning are nearly always lower, often by fifty percent or more, than those of on-campus classes. Moreover, in most cases the technology used to deliver distance learning does not appear to be particularly crucial to its success. Most studies find no significant differences in student learning for courses taught using different media technologies.[20]

However, it takes more motivation to pursue classes on one's own than in a group setting, and thus completion rates can be much lower for distance learning than for classroom courses. For this reason, institutions providing distance learning often build in faculty-student and group discussions via telephone, audio- or videoconferencing, or (preferably) face-to-face meetings. The Open University in the United Kingdom, a world leader in distance learning for more than twenty-five years, finds such interactions essential to student success and schedules face-to-face tutorials as an integral part of each distance-learning course.

Still, distance learning is clearly less effective than time spent on-campus in helping students form academic relationships, business networks, and friendships. These benefits are less readily measurable than test results but very important to career and personal success. As John Seely Brown and Paul Duguid point out in a recent article, "People leave college knowing not just things, but knowing people, and knowing not just academic facts, but knowing social strategies for dealing with the world. Reliable friendships and complex social structures aren't picked up through lectures, but they give an education much of its value."[21]

Advantages and Disadvantages of the Internet for Distance Learning

Compared with other media for distance learning, the Internet offers more interactivity, greater flexibility, more functionality, and potentially lower costs:

- *Interactivity.* The Internet is inherently a two-way medium that facilitates both one-to-one and group communication, both in real time and asynchronously. Much of the educational promise of the Internet lies in its ability to foster interactive *learning communities* in which participants routinely exchange information, debate course topics, and build relationships through informal discussion and social chat. This interactive capability addresses the chief weakness of other distance-learning media that are either one-way (print materials, radio and television, audio- and videotapes, computer software and CD-ROMs), or cumbersome and expensive for group discussions (audio- and videoconferencing). Internet communication today is principally via e-mail, but the software for voice messaging and real-time conversation is diffusing rapidly, and two-way video will likely be available and affordable within the next five years.

- *Flexibility.* The Internet provides on-demand access to course materials and discussions at the student's preferred time and place. Information and messages can easily be sent to an individual or shared with the entire class. Course materials or links to other sites can be rapidly updated and made available to all participants simultaneously. Students and instructors also can exchange information and communicate using different equipment, which is generally not possible on other proprietary computer networks.

- *Functionality.* Through the Internet, students can have ready access to image and audio, as well as

text materials. Today, the low data rates available using standard telephone lines and modems make extensive use of full-motion video impractical, but new digital compression and transmission technologies over telephone and cable networks should reduce these bottlenecks within the next five to ten years.[22]

- *Cost and access.* For academic institutions, providing instructional materials on the Internet should be less expensive than delivering the same materials through the mail or over broadcast media. For students, usage costs are quite low once they have obtained Internet access, particularly compared with using other interactive media such as audio- or videoconferencing. However, the initial costs of acquiring a computer, an Internet connection, and (especially) the skills to use them effectively present barriers for many students. These barriers are decreasing over time as more people own computers and become familiar with the Internet, but they nevertheless will pose constraints on Internet distance learning for at least the next decade.[23]

Current Use of the Internet for Distance Learning

A great many academic institutions that offer distance learning are using or experimenting with the Internet for off-campus instructional delivery. Some interesting examples:

- The Open University, a long-time leader in distance learning, is only now beginning to offer instruction via the Internet.[24] The Open University's record of success is based on supplementing individual self-study with feedback from assigned tutors via mail, telephone, and face-to-face tutorials. Currently, only three computing courses (out of more than three hundred courses available) use the Internet. Students in these courses can submit assignments, communicate with their tutors, and participate in some tutorials via e-mail. Most course materials (including paper documents, audiotapes, and videotapes) are still sent by mail, and students must attend the final examination in person. The Internet courses are targeted to "those who live far away from our study centres in the UK, Ireland, and Continental Western Europe or whose employment or domestic situation makes it difficult for them to travel to a study centre."[25]

- The California State University (CSU) system is making a major effort to use the Internet for graduate, undergraduate, and non-degree distance learning.[26] As an example, CSU–Dominguez Hills offers a fully accredited graduate degree program—the Master of Science in Quality Assurance (MSQA)—over the Internet. More than fifty students from the United States and seven other countries are enrolled in MSQA On-Line, "a series of Web sites that allow students to download the student handbook, review course syllabi, register for courses, attend lectures, do their assignments, use resources, participate in class discussions, network with other students, and communicate with their professors.[27]" CSU–Sonoma State has designed a Composite B.A. Degree Program in Liberal Studies for students who have completed their first two years of general education. Students enrolling in this program must attend classes on campus one Saturday per month, but they otherwise participate via the Internet. And (as discussed later in this chapter), CSU–Long Beach is working with a for-profit firm, UOL Publishing, Inc., to offer courses on the Internet leading to a Certificate in Planned Giving.[28] Overall, by the end of 1997, eighteen of the twenty-three CSU campuses were offering online courses.[29]

- Two leading campuses of the University of California have joined with for-profit firms to offer extension courses over the Internet. UCLA Extension is collaborating with the Home Education Network; currently about a thousand students in forty-four states and eight countries are enrolled in some fifty courses taught over the Internet.[30] UC–Berkeley Extension is working with America

Online to offer about forty online courses.[31] UC–Berkeley Extension and UOL Publishing, Inc., have also signed an agreement to develop and distribute over the Internet, beginning in fall 1997, seven marketing courses leading to a Certificate in Marketing.[32]

- Duke University's Fuqua School of Business offers a Global Executive M.B.A. program by e-mail over the Internet. Nearly half of those enrolled in this new program live outside the United States.[33]

- Park College, which focuses on undergraduate degree completion programs for U.S. military service enlistees and their dependents, has made a strong commitment to using the Internet for distance learning. Begun on a trial basis in 1996, Park College Online now offers more than twenty degree-credit courses over the Internet in biology, chemistry, computer science, criminal justice, English, history, management, marketing, and social psychology.[34]

- Virginia Commonwealth University (VCU) and the Medical College of Virginia (MCV) offer an Executive Masters Program in Health Administration that combines on-campus with Internet-based instruction.[35] During the two-year program, students attend five one- to two-week sessions at the MCV campus in Richmond, Virginia; they complete the rest of their course work off site using e-mail and the World Wide Web.

"Virtual Universities"

The concept of the virtual university involves broader and more ambitious goals than other distance-learning programs. As the term is used here, the core mission of a virtual university is to offer complete academic degree programs—and usually non-degree courses as well—on the Internet to students who are widely dispersed geographically. Student presence on-campus is not required to earn course credits or degrees, although (like several of the distance-learning examples described above) virtual universities may want to supplement electronic tutorials and group discussions with some face-to-face interactions. Virtual universities will still use books and other instructional media such as audio- or videotapes and software/CD-ROMs, but their central focus is on interactive learning via the Internet.

While a variety of academic and non-academic programs use the terms "virtual university" or "virtual campus" to describe themselves, the following appear to be among the most comprehensive examples:

- The Western Governors' University was announced in December 1995 when the governors of eleven Western states agreed to explore the creation of a virtual university.[36] The Western Governors' University expects to become operational in early 1998. As currently envisioned, the Western Governors' University will be an independent, nonprofit, accredited degree-granting entity drawing on faculty from other public and private institutions in the region to teach courses using the Internet and other distance-learning technologies. It will emphasize practical competency-based degrees and certification, rather than traditional academic credits earned by what is called "seat-time." "Market-oriented" and "client-centered, focusing [on] the needs of students and employers,"[37] it will offer an Associate of Arts degree and certification for electronic technicians. It will also broker distance-learning courses for other participating institutions.

- International University was founded in 1995 by Glenn Jones, a communications and higher-education entrepreneur, to provide Internet-based undergraduate and graduate "degree courses, non-credit courses, certificates of specialization, and degree programs."[38] International

University offers both a B.A. completion program (for students who have two to three years of undergraduate credits from another institution) and an M.A. in Business Communications, as well as certificates of specialization in that field. No degrees have been awarded as yet, but the school has been granted candidacy status for accreditation by the North Central Association of Colleges and Schools. International University's focus on online delivery complements other of Jones' enterprises that employ broadcast television, cable, satellite, videotape, software, and CD-ROM technologies for distance learning.

- Athena University, a nonprofit subsidiary of Virtual Online University, Inc., provides interactive, Internet-based courses that diverge further from traditional academic offerings than the other distance-learning examples cited in this section. Athena's instructional delivery model "is constructed on an Internet program called a Multi-User, Object Oriented (MOO) environment,"[39] in which faculty and students can interact with each other as "cyber-objects" as well as exchange messages and information. Athena intends to offer both an undergraduate liberal arts degree and an M.B.A. in New Technologies for New Management Strategies, and is seeking accreditation from the North Central Association of Colleges and Schools.

PRIVATE-SECTOR INTERESTS IN INTERNET-BASED EDUCATION

Private-sector firms have several distinct roles to play in Internet-based post-secondary education and training:

- as vendors of hardware and software
- as system developers, system integrators, and publishers
- as commercial providers of corporate training
- as consumers of employee training and education
- as operators of for-profit, degree-granting institutions

Hardware and Software Vendors

Higher education is an important market for vendors of telecommunications and information systems hardware and software. It is in these firms' direct interest to work closely with academic administrators and faculty on plans to upgrade the campus information infrastructure and expand distance learning. As one example, the League for Innovation in the Community Colleges receives considerable support for its Information Technology Initiative from more than fifty "corporate partners" including Apple Computer, IBM, Microsoft, Oracle, and U.S. Robotics.[40] And Silicon Graphics and Sun Microsystems, not surprisingly, are among the sponsors of Web-based courses on Structure-Based Drug Design and Bioinformatics Tools offered by the Department of Pharmaceutical Sciences at the University of Nottingham.[41]

System Developers and Publishers

Many companies view Internet-based education as a growth market and are positioning themselves to serve it. Two leading examples are IBM and UOL Publishing, Inc.

IBM. In October 1996, IBM announced its Global Campus, described as "a breakthrough education and business framework that helps colleges and universities use computer networks to redesign learning, teaching, and administrative functions."[42] Still under development, the IBM Global Campus will provide a common software and administrative framework—using Lotus Notes and other IBM products—for

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Web-based courses offered by participating university and college "affiliates." The initial affiliates include all twenty-three campuses of the California State University system and thirty-two other colleges and universities in the U.S., Australia, Canada, Mexico, Brazil, and Venezuela.

IBM will not develop courseware for the Global Campus itself (at least for now), but it plans to offer technical and administrative services to both students and educational institutions, ranging from Internet access to course registration to online student discussion groups. IBM will also facilitate the development and sharing of authoring tools, instructional modules, and online catalogs for Internet-delivered courses. The IBM Global Campus is both an ambitious future-oriented concept for Internet-based instruction and a focused marketing campaign to sell Lotus Notes software, "Domino" Web servers, and other IBM products into the higher-education sector.

UOL Publishing, Inc. A relatively new company, UOL is positioning itself as a publisher and distributor of courses on the Internet for both academic institutions and business firms.[43] UOL will either commission development of courseware for Internet delivery, like a traditional publisher, or partner with institutions that develop their own courses. It will then market the courses to other institutions, with current licensing fees of about $100 per student per course. The courses will be available on UOL's Web server, and UOL will also provide administrative services (including registration, grading, accounting, and reporting) on a turnkey basis for participating institutions.

UOL Publishing's initial group of academic partners is mostly offering certificate and other non-degree programs, or pilot-testing courses for degree credit. As examples:

- CSU–Long Beach offers a Certified Specialist in Planned Giving Program through its University College and Extension Program.[44] The program consists of six modules, the first two of which are available online from UOL Publishing. Students complete the remaining four modules on the CSU–Long Beach campus.

- Georgetown University School of Business gives a certificate to students who complete an online course in International Business through UOL.[45]

- George Mason University (GMU) offers two online courses, one in Financial Accounting and one in Managerial Statistics, both of which can be taken for degree credit in the GMU Graduate Business Institute.[46]

Other UOL Publishing academic partners include George Washington University, New York University, Park College, the University of Toledo, and Xavier University.

Overall, UOL Publishing's business plan to create, market, and distribute online courses in partnership with academic institutions seems well-thought out, and its initial focus on extension and certificate courses seems realistic in the current environment. Whether UOL's course offerings can move into the degree-granting academic mainstream, however, remains to be seen.

Commercial Providers and Users of Corporate Education and Training

Corporate education and training in the United States represents a $50 billion annual business that is forecast to grow steadily as companies invest in their human capital for competitive advantage in global markets.[47] Although computer-based training will not replace instructor-led, classroom training for many applications, both commercial providers of training and corporate users see Internet- and Intranet-based

instruction as productivity-enhancing tools. In particular, Web-based training can follow initial classroom training; and it can be taken at the employee's convenience, often outside of normal working hours. It thus can significantly reduce the travel costs and paid staff time that would otherwise be spent on additional classroom training.

Software firms are among the leaders in experimenting with Internet- and Intranet-delivered instruction:

- After about two years of testing Web-based training, Microsoft is now aggressively promoting it through its Microsoft Online Institute (MOLI).[48] Microsoft provides the Web infrastructure and administrative services, but the actual courses are developed and offered by third-party training organizations whose content has been approved by Microsoft. The focus is on training information technology specialists to use Microsoft products; a student can become a Microsoft Certified Professional through online instruction. Microsoft is also encouraging its classroom-based Authorized Technical Education Centers (ATECs) to set up parallel Internet training through MOLI.

- Oracle, the second largest software company, also has established an Internet-based training environment called Oracle Learning Architecture (OLA).[49] Like Microsoft, Oracle's initial market is professionals whom it trains to use the company's products, but Oracle intends to expand OLA to serve a far broader range of corporate training applications.

- Novell Education trains and certifies administrators, instructors and engineers in the use of Novell software products. Novell is actively pursuing asynchronous, Web-based training to supplement and partially substitute for the 750,000 student courses taken each year in instructor led, classroom training.[50]

- Autodesk, a leading supplier of PC-based design software, has established its Autodesk Virtual Campus in partnership with UOL Publishing to offer computer-aided-design courses over the Internet.[51] The Autodesk Virtual Campus also provides technical support, discussion groups, and job listings. Autodesk and UOL are partnering with a number of other firms to develop content for specific courses.

Most other commercial training providers are planning to deliver or at least considering providing courses over the Internet. As one example, Dun & Bradstreet Information Services now conducts a Web-based training seminar to teach customers how to use the DIALOG information retrieval service, the first of many training seminars it hopes to offer online.[52] Although up to now, Web-based corporate training has focused on computer-related topics and skills, the widespread corporate use of Internet and Intranet sites will inevitably carry Web-based training with it into other, nontechnical areas.

For-Profit, Degree-Granting Institutions

Although proprietary trade schools have been an important segment of post-secondary education for many years, for-profit entities generally have not been accredited for granting undergraduate or graduate degrees. One interesting exception is the University of Phoenix, a for-profit subsidiary of Apollo Group, Inc., which is accredited to grant bachelor's and master's degrees by the North Central Association of Colleges and Schools. Founded in 1976, the University of Phoenix focuses on providing practical degree programs for working adults. With forty thousand students enrolled on more than fifty campuses, it has become the largest private university in the United States.[54]

The University of Phoenix began testing asynchronous, computer-based instruction in 1989 and now has some twenty-six hundred students enrolled in its online degree programs.[55] Online students usually are older than on-campus students (late thirties to early forties) and have previously earned some college credits from another institution. On average, they take slightly more than 100 online course credits in two-and-one-half to three years to complete the requirements for a Bachelor's degree in Business. The individual online course- and degree-completion rates are an impressive ninety-three percent and sixty percent, respectively,[56] about the same as those for successful on-campus programs. The University of Phoenix also offers, via the Internet, continuing professional education courses with Certificates of Completion.

DISCUSSION

As the previous sections of this chapter have indicated, information technology in general and the Internet in particular show real potential in post-secondary education for improving instructional quality, student access, and productivity. There are, of course, tradeoffs among these goals, but experience from process reengineering in industry suggests that all three can and should be addressed simultaneously. Foremost among the important issues are questions of instructional cost, student access, the relationship between the private sector and academia, and the impact of the Internet on education.

The Instructional Cost Problem

Most efforts to date to use the Internet in higher education have concentrated on the goals of improving quality and student access. Improving productivity by reducing instructional cost has played a lesser role, for a variety of reasons:

- Existing courses cannot simply be transplanted onto the Internet. Developing courseware for Internet delivery requires a considerable investment of faculty time that typically brings scant monetary or professional rewards.
- Enthusiasts usually discount the amount of human support needed for effective PC- or Internet-based learning. Such underestimates are consistent with business experience that annualized PC costs break down roughly into twenty percent hardware and software costs, and eighty percent people costs.
- Research universities have had (at least up to now) little incentive to reduce instructional costs, since they represent a relatively small percentage of overall operating costs.
- State funding for higher education is often based on student on-campus attendance ("seat time"), with institutions receiving less for courses taught using the Internet or other modes of distance learning.
- Faculty may explicitly or implicitly resist changes that they believe threaten their jobs or academic roles.
- Colleges and universities have relatively little control over faculty labor costs, at least in the short run, so information technology usually increases short-run operating costs.

Although there are good reasons to think that Internet-based instruction, used appropriately and effectively, can reduce instructional costs, scant evidence or business modeling exists to support such

beliefs.[57] Indeed, some universities currently charge more for online courses than for conventional on-campus classes[58] (although students taking online classes may have lower net costs after considering transportation costs and lost income from traveling to campus). Including productivity/cost improvement as an explicit goal of Internet-based course design seems likely to have significant payoff.

How Quickly Will Colleges and Universities Adopt the Internet?

In light of the breadth and diversity of American higher education, colleges and universities are likely to use the Internet for instruction in quite different ways. Currently the major research universities are embarking on extensive (and expensive) programs to make wideband Internet connectivity ubiquitous on campus. They are driven to do so because they believe it necessary for them to remain competitive for attracting the best students and faculty. Greater use of the Internet should on the whole lead to improved quality of undergraduate and graduate instruction, and to better on-campus administrative services, but it seems unlikely by itself to bring about overall productivity gains. However, a robust campus information infrastructure certainly will support broader restructuring and reengineering efforts that could reduce instructional costs and increase productivity.[59]

Research universities also will seek to broaden access through increased use of Internet-delivered courses to degree and non-degree students off-campus. Although access is not the highest internal priority for most elite institutions, developing new revenue streams from off-campus students is of interest to all of them. University alumni seem a particularly attractive market for Internet-delivered continuing education. Moreover, these institutions' prestige and "brand-name" identification make them attractive partners for commercial firms that offer education and training over the Internet. (This topic is discussed further below.)

Innovative use of the Internet to expand access seems more likely to come from the community colleges and the less-elite colleges and universities.[60] These institutions face severe financial pressures to expand enrollments while reducing per-student costs. Their faculties retain control over courses and curricula, and they are not yet comfortable with the Internet as a core instructional medium, but they seem more amenable than are research university professors to using course materials prepared by others. Their students also want the kind of practical, job-related education that fits well into a distance-learning paradigm.

Community colleges, state colleges, and other institutions that have well-developed distance-learning programs should generally embrace the Internet as a technologically richer, more flexible, way to reach off-campus students. It seems likely to become a lower-cost medium as well, once courseware and operating procedures are developed; but again there are scant current data to confirm or refute this claim. Problems of providing low-cost equipment and Internet service to rural and low-income students remain, but access is steadily expanding and should accelerate as Universal Service subsidies for school and library Internet services become available in 1998.[61]

Will the Private Sector Compete More Strongly With Academia?

At present, the lines between private-sector and academic providers of post-secondary education and training are still fairly distinct, with the exception of a few boundary-crossing organizations such as the for-profit University of Phoenix. Nevertheless, more confrontations between the two sectors seem likely as the Internet becomes an important teaching and learning platform for nontraditional, off-campus students.

Microsoft, Oracle, and other software companies are building extensive infrastructures for providing their own professional training over the Internet. Once their infrastructures are in place, they will be well-positioned to offer other courses and educational programs to students "anywhere, anytime." They will surely seek institutional academic partners in some areas, as IBM and UOL are doing; but they also can develop courseware independently, like publishers, by hiring individual scholars or practitioners. Microsoft in particular is committed to developing content for the Internet in a publishing-like mode.[62]

Moving from providing infrastructure and publishing courseware to actually offering Web-based courses seems a logical next step. With greater marketing prowess, lower cost structures and fewer institutional constraints than academic institutions, private firms may be able to use the Internet to compete effectively for students in some areas of non-degree instruction that colleges and universities now dominate, such as:

- remedial courses for entering college students
- extension courses for adults
- professional continuing education
- "short courses" for managers and executives

This line of argument does not suggest that academic institutions are fated to lose out in providing education to non-degree students. Many adults want to come to a physical campus for personal interactions with faculty and students, as well as for instruction. Some classes demand one's physical presence and cannot be taught over the Internet. And outside of purely technical training, certificates or other credits awarded by leading colleges and universities still carry more cachet than those given by commercial firms.

Partnerships between for-profit firms and academic institutions seem the most likely arrangements for offering Internet-based education to non-degree students. But if businesses adapt more rapidly to the new environment and invest more in Internet-based education, they will demand a larger share of the resulting revenue. A quite plausible future scenario would see the commercial partner providing the Internet infrastructure (hardware, software, and communications), much of the course content, administrative services, marketing, and most of the direct contact with students. The academic partner would provide its name on the courses and on the student's Certificate of Completion, as well as take responsibility for student selection, quality control over course content, interactive sessions, and grading.

One clear implication of this scenario is that commercial firms that develop these capabilities will seek out the most prestigious academic partners to offer courses nationally and internationally. In marketing to students, they will have little reason to respect the geographical or subject-area "turf" of other academic institutions. Such increased competition could put financial pressure on less prestigious schools whose current plans assume substantial revenue from non-degree students. However, such schools can respond competitively by becoming expert in particular content areas (e.g., the Certified Specialist in Planned Giving Program offered online by CSU–Long Beach) and by providing superior services to online students (e.g., real people to talk with when problems arise).

Similar business/academic partnership models also apply to degree-credit courses offered via the Internet, but here the value-added and bargaining position of the academic partners seem stronger. Faculty generally are much more concerned about retaining control over degree programs, so they will want the commercial partner to play a supporting role. Academics also control the organizations that accredit degree programs. Still, firms should be able to find cooperative and accredited academic partners with whom to offer Internet courses for degree credit. This could well become the evolutionary path for virtual universities that offer complete degree programs over the Internet.

Will the Internet Transform Higher Education?

Although any projections of the Internet's future impact should be viewed with skepticism, if not downright alarm, the title of this chapter seems to demand some speculative concluding comments. What follows, though, should be considered more of a scenario than a forecast.

In the near term, most higher-education institutions will use the Internet incrementally to improve administrative processes, on-campus instruction, and distance learning. It will rather quickly become the preferred means to reach off-campus students. But it will be viewed more as a powerful technical tool than as a catalyst for institutional change. "Regulation, bureaucracy, tradition, and turf"[63] will remain barriers to more fundamental academic restructuring, particularly in the elite research universities where faculties have the greatest degree of power and control.

A few academic institutions, spurred by vision or crisis, will seek to reorient instruction toward distributed, student-centered learning with heavy use of Internet-based courseware, discussion groups, and links to other online resources. This seems likely to occur first for continuing education, job-related training, and other non-degree courses, as well as for the expansion of current distance-learning programs. For-profit firms will also move beyond their traditional corporate training markets within the next few years to deliver educational courses more widely via the Internet, often in partnership with academic institutions. Competition for non-degree students will thus become more intense and should lead to lower student costs per course—beginning with Internet-based classes, but probably then spreading to other modes of instruction.

Degree programs will migrate to the Internet more slowly, although most colleges and universities will soon offer at least some courses online for degree credit. Internet-based, virtual universities will provide the lowest-cost degree options, but geography and face-to-face interaction will still play important roles in attracting degree students. Nevertheless, ready availability of courses over the Internet at lower net cost to the student will encourage more off-campus learning. Rather than today's dichotomy between "traditional" and "nontraditional" students, more students will earn their degrees by taking a mix of on-campus and Internet-based, off-campus courses. And as competition increases, students will be able to take more Internet courses for credit from sources other than their own degree-granting institution.

Finally, learning from the Internet will complement rather than supplant on-campus traditional higher education. Peter Drucker notwithstanding, one should not expect residential colleges and universities to disappear within a generation. A great many young adults still want the face-to-face instruction and social interactions they get on campus, even if it is more expensive than distance learning. For most secondary-school graduates, the issue will not be choosing between full-time, on-campus study and 100-percent distance learning, but selecting a mix that is educationally sound, accessible, and affordable. In this sense the Internet may not transform higher education, at least for the foreseeable future,[64] but it will enrich the educational choices generally available to all categories of learners.

NOTES

1. While the Internet is a global phenomenon, and innovations on the Internet have global impact, most of the early applications of the Internet to instruction in higher education are occurring in the United States. This article, therefore, mostly focuses on the use of the Internet in American higher education.

2. This chapter uses the terms "higher education" and "post-secondary education" interchangeably. Some might argue that "higher

education" should be reserved for degree-granting colleges, universities, and graduate professional schools, and that "higher education" is thus a subset of "post-secondary education," which would also include trade schools, continuing education and other non-degree programs, and corporate and military training. However, as this chapter argues, the boundaries between the two categories are blurring so that these distinctions will become less meaningful over time.

3. David MacArthur and Matthew Lewis, *Untangling the Web: Applications of the Internet and Other Information Technologies to Higher Education* (Santa Monica, CA: RAND, DRU-1401-IET, June 1996.

4. See, for example, Suzanne E. Thorin and Virginia D. Sorkin, "The Library of the Future," in *The Learning Revolution*, ed. Diana G. Oblinger and Sean C. Rush (Bolton, Mass.: Anker Publishing Co., 1997), 164-79.

5. Interview with Peter Drucker, *Forbes*, 10 March 1997. See also similar comments by Eli Noam, "Electronics and the Dim Future of the University," *Science*, 13 October 1995, 247-49.

6. Several Web sites now specialize in tracking such projects and providing direct links to them. See, for example, Cape Software's site, "The Internet University: College Courses by Computer," available online at http://www.caso.com, and the Globewide Network Academy at http://uu-gna.mit.edu:8001/uu-gna/. An annotated compendium, "Learning over the Internet: Courses, Curricula, Programs, Syllabi, etc.," is maintained by Carolyn Kotlas of the Institute for Academic Technology, University of North Carolina, and is available online at http://www.iac.unc.edu/guides/irg-38.html.

7. The National Learning Infrastructure Initiative (NLII) is a project of EDUCOM (http://www.educom.edu), a consortium of colleges that focuses on the use of communications and information technologies in higher education. See "NLII Call to Participate, EDUCOM's National Learning Infrastructure Initiative," November 1994; available online at http://www.educom.edu/program/nlii/keydocs/call.html.

8. The list of "classes with Web resources" at the University of Illinois at Urbana-Champaign is available online at http://www.uiuc.edu/webclasses.html.

9. Kenneth C. Green, "1997 Campus Computing Survey," reported in *The Chronicle of Higher Education*, 17 October 1997.

10. The Alfred P. Sloan Foundation, for example, has given over $15 million in grants since 1993 to more than forty colleges and universities for such projects through its Asynchronous Learning Networks (ALN) program. See the Sloan Web site at http://www.sloan.org/education/ALN.new.html. For an excellent summary of the program by the ALN program director, see A. Frank Mayadas, "Asynchronous Learning Networks: New Possibilities," in *The Learning Revolution*, 211-30.

11. A 1994 survey of high-school graduates of the class of 1990 found that seventy percent of those enrolled in a college or university reported regularly using a computer, compared with fifty-seven percent of those not attending college. See *Science and Engineering Indicators 1996* (Washington, DC: National Science Foundation, NSB-96-21, 1996), 7-17. Those percentages are certainly larger today.

12. "Internet Rationing Hits Higher Ed," *The Chronicle of Higher Education*, 4 October 1996, A23.

13. See the "World Lecture Hall" at the University of Texas, available online at http://www.utexas.edu/world/lecture/index.html; also see the University of Houston's "Archive.edu" online at http://www.coe.uh.edu/archive/.

14. See the World Lecture Hall's list of online economics courses at http://www.utexas.edu/world/lecture/eco/. This Microeconomics course from the University of Delaware can be found online at http://medusa.be.udel.edu/WWW_Sites/oo_Micro.html.

15. Beginning in 1988, Rensselaer Polytechnic Institute (RPI) redesigned its introductory undergraduate courses in mathematics, physics, chemistry, biology, and engineering to emphasize cooperative group learning with extensive use of media and computers. Large lectures and traditional laboratories have been de-emphasized in favor of small-group "studio" sessions and computer-based data acquisition and analysis. RPI's studio courses require fewer contact hours and have lower costs than did the traditional courses they replaced. Moreover, "evaluations are demonstrating that students learn the material better and faster." See Jack M. Wilson, "Reengineering the Undergraduate Curriculum," in *The Learning Revolution*, 107-128.

16. Some comparisons among media for distance learning can be found in Lynnette R. Porter, *Creating the Virtual Classroom: Distance Learning with the Internet* (New York: John Wiley & Sons, 1997).

17. Prospectus, UOL Publishing, Inc., 26 November 1996, 31.

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18. "'[There] is evidence that there's money to be made in this business,' says Jim Mingle, executive director of the State Higher Education Executive Officers." See "Ivy League Eyes Distance Learning," *The Chronicle of Higher Education*, 20 June 1997.

19. As Terry Anderson writes in "Alternative Media for Education Delivery" (http://www.atl.ualberta.ca/papers/alt_media.html), ". . . research over the past seventy years has generally concluded that there are no significant differences between learning delivered face-to-face and that delivered by alternative media."

20. Professor Richard Clark of the University of Southern California concluded his 1983 review article with a strong affirmation of this point: ". . . media are mere vehicles that deliver instruction, but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition." R. E. Clark, "Reconsidering Research on Learning from Media," *Review of Educational Research* 53, no. 4 (1983): 445. See also Thomas L. Russell, "The 'No Significant Difference' Phenomenon as reported in 248 Research Reports, Summaries, and Papers" (4th ed.), available online at http://tenb.mta.ca/phenom/nsd.doc.

21. John Seely Brown and Paul Duguid, "Universities in the Digital Age," *Change*, July/August 1996, 11-19.

22. Higher-speed Internet access via Digital Subscriber Lines (xDSL) and cable modems is now in the early stages of deployment in the telephone and cable networks, respectively. How quickly it will become available and affordable for distance learning depends on a variety of technical, market, and regulatory developments; but the trends seem promising. Paul Kagan Associates, a firm that tracks media market developments, forecasts that five percent of home Internet subscribers will have high-speed access within ten years. See "Kagan Forecasts $46B in Interactive Revenue by 2007," *Cowles/Simba Media Daily*, 30 July 1997.

23. An April 1997 survey for *Business Week* found that twenty-nine percent of respondents aged eighteen to twenty-four were Internet users—twice the percentage reported in 1996. An additional twelve percent used online services such as America Online or CompuServe. Moreover, a recent *Sports Illustrated* survey reported that about half of the nine-to-thirteen-year-olds polled had used online services or the Internet. "*Business Week*/Harris Poll: A Census in Cyberspace," *Business Week*, 5 May 1997; "What Kids Do On-Line," *USA Today*, 23 June 1997.

24. See the Open University online at http://eszx.open.ac.uk/.

25. Quoted from the Open University's home page at http://eszx.open.ac.uk/zx/HomePage.html.

26. See MSQA On-Line at http://www.csudh.edu/msqa/msqahome.htm, and CSU–Sonoma State's Composite B.A. Degree Program in Liberal Studies online at http://www.sonoma.edu/exed/lsdep/ls2.html.

27. CSU Commission on the Extended University, "Annual Report 1995" (Long Beach, Calif.: California State University, 1996), 11.

28. See the CSU–Long Beach Certified Specialist in Planned Giving Program online at http://www.uol.com/csulb.

29. Elaine Woo, "Virtual Colleges," *Los Angeles Times Campus and Career Guide*, 20 July 1997, 2.

30. See the Home Education Network at http://www.then.com/.

31. Cited in Woo, "Virtual Colleges." See UC–Berkeley Extension online at http://www-cmil.unex.berkeley.edu/online/.

32. "UOL Publishing and UC–Berkeley Extension Sign Agreement to Launch Online Education Program," News Release, 19 May 1997; available online at http://www.uol.com/.

33. Lisa Gubernick and Ashlea Ebeling, "I Got My Degree Through E-mail," *Forbes*, 16 June 1997, 84-86. See the Fuqua School of Business online at http://www.fuqua.duke.edu/programs/gemba/index.htm.

34. See Park College online at http://www.park.edu/dist/course.html.

35. See the VCU/MCV Executive Masters Program in Health Administration online at http://www.vcu.edu/mdcweb/haeweb/.

36. Western Governors' Association, press release, 1 December 1995. (See the Western Governors' University online at http://www.west.gov.org/.) Governor Pete Wilson of California declined to join the Western Governors' University consortium and subsequently established a separate California Virtual University Design Team (Governor's Office, press release, 4 April

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1997).

37. Michael O. Leavitt, "The Western Governors' University: A Learning Enterprise for the CyberCentury," quoted at http://www.west.gov.org/smart/vu/faq.htm; reprinted in *The Learning Revolution,* 180-94. Much of the detailed planning that describes the structure, financing, and operation of the Western Governors' University is available online at http://www.west.gov.org/smart/vu/vu.htm.

38. Quoted online at http://www.international.edu/iu/mission.html.

39. Quoted online at http://www.athena.edu/overview.html.

40. See the League for Innovation in the Community Colleges online at http://www.league.org/itpartnr.html.

41. See the online list of the University of Nottingham's Web-based courses at http://www.vsms.nottingham.ac.uk/vsms/catalog.html.

42. Quoted from IBM press release, 10 October 1996. See the IBM Global Campus online at http://www.hied.ibm.com/igc/.

43. See UOL Publishing, Inc., online at http://www.uol.com.

44. See the CSU–Long Beach Certified Specialist in Planned Giving Program online at http://www.uol.com/csulb.

45. See the Georgetown University School of Business online course at http://www.uol.com/georgetown/.

46. See the GMU program online at http://www.pubs.gmu.edu/catalog/gradbusi.html.

47. The Bureau of the Census, Department of Commerce, estimates a 1995 total of $52 billion for corporate training and education. Although the available disaggregated data are not very precise, as much as $10 billion of corporate training is now delivered via PC software, CD-ROM, videotape, videodisk, client-server computer systems, Internet, and Intranets. The Gartner Group projects that the demand for technology-based training will rise 10 percent a year for the next two years. Quality Dynamics, Inc. predicts that by the year 2000, "half of all corporate training will be delivered via technology." Both quoted in *Information Week*, 4 November 1996, 32.

48. See the Microsoft Online Institute online at http://moli.microsoft.com/.

49. See Oracle at http://ola.us.oracle.com/.

50. Russell Poulin and John Witherspoon discuss Novell Education (http://education.novell.com/) in "Best Practices in Implementation of Advanced Educational Technologies," Western Interstate Commission for Higher Education, Boulder, Colo., April 1996.

51. See Autodesk's Virtual Campus at http://www.vcampus/com.

52. See Dun & Bradstreet Information Services online at http://www.uol.com/dbis/.

53. See the University of Phoenix online at http://www.uophx.edu; see Apollo Group, Inc., online at http://www.apollogrp.com.

54. Ethan Bronner, "University for Working Adults Shatters Mold, *New York Times*, 15 October 1997, A1.

55. The figure of twenty-six hundred online students is reported in "For-Profit U.," available online at http://www.forbes.com/forbes/97/0616/5912084a.htm. Degrees offered by the University of Phoenix for online study are: B.S. in Business, M.B.A., M.A. in Organizational Management, and M.S. in Computer Information Systems. See http://www.uophx.edu/online.

56. Poulin and Witherspoon, "Best Practices in Implementation of Advanced Educational Technologies."

57. Cost studies have been commissioned by the League For Innovation in the Community Colleges and the Western Governor's University, among others, but their results are not yet publicly available.

58. Gubernick and Ebeling, "I Got My Degree Through E-mail." The higher cost of Internet over conventional courses at these

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campuses (Duke University, University of Maine, University of Phoenix) probably reflects institutional estimates of student demand elasticity rather than any underlying cost structure.

59. William F. Massey, "Life on the Wired Campus: How Information Technology Will Shape Institutional Futures," in *The Learning Revolution,* 195-210. For an estimate of faculty time and resulting cost savings from the RPI studio courses, see William F. Massy and Robert Zemsky, *Using Information Technology to Enhance Academic Productivity* (Washington, DC: EDUCOM, 1995).

60. See, for example, Terry O'Banion, "Transforming the Community College from a Teaching to a Learning Institution," in *The Learning Revolution,* 138-53.

61. Federal Communications Commission, *Universal Service Report & Order*, FCC 97-57, Section 10, 7 May 1997.

62. All of the major academic publishers are jockeying for roles as creators and distributors of Internet-based courseware. One might also expect to see non-publishing firms such as AT&T, EDS, Sylvan Learning Systems, Andersen Consulting, Bellcore/SAIC and others, including many outside the U.S., enter the Internet education and training market.

63. Clara Lovett, President of Northern Arizona University, quoted in Leavitt, "The Western Governors' University."

64. Others may be more willing to forecast a specific date by which higher education will have profoundly changed. For example, Peter Schwartz, the prominent futurist, and Peter Leyden present a scenario in which information technology first spurs innovation and reform in U.S. elementary and secondary schools "starting in earnest in 2000." The scenario continues:

> Higher education, though slightly less in need of an overhaul, catches the spirit of radical reform. . . . The vigorous adoption of networking technologies benefits undergraduate and graduate students even more than K-12 kids. In 2001, Project Gutenberg completes its task of putting ten thousand books online. Many of the world's leading universities begin carving off areas of expertise and assuming responsibility for the digitalization of all the literature in that field. Around 2010, all new books come out in electronic form. . . .

Peter Schwartz and Peter Leyden, "The Long Boom: A History of the Future, 1980-2020," Wired, July 1997, 169-70.

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